

## **Epizootic Hemorrhagic Disease**

Hemorrhagic Disease is the most important infectious disease of white-tailed deer, and outbreaks occur almost every year in the Southeast. It is caused by either of two closely related viruses, epizootic hemorrhagic disease (EHD) virus or bluetongue virus. Because disease features produced by these viruses are indistinguishable, a general term, hemorrhagic disease, often is used when the specific virus responsible is unknown. Because EHD and bluetongue viruses are transmitted by biting flies, hemorrhagic disease is seasonal and occurs in late summer and early fall.

### **The Virus**

There are 2 subtypes of EHD virus and 5 subtypes of bluetongue virus in North America. It is suspected that there is variation in ability among these subtypes or even with strains of each subtype to cause illness in deer. Furthermore, it is unlikely that recovery from infection with one virus subtype will protect the deer from infection with another. EHD and bluetongue viruses are not new to North America, as infections in deer were first reported in 1955 and 1968, respectively. Even earlier, deer die-offs resembling hemorrhagic disease were described as "blacktongue" by several naturalists in their writings.

Hemorrhagic disease viruses cannot survive outside the host animal or biting fly vector. When deer die, EHD or bluetongue virus will deteriorate rapidly in the carcass, and virus isolations are seldom obtained beyond 24 hours after death. Therefore, a live sick deer or a freshly dead deer is needed to make a virus isolation and determine which virus is present.

### **The Vectors**

Neither EHD nor bluetongue virus is spread by direct contact. Both are transmitted by tiny biting flies in the genus *Culicoides*. The best documented vector in North America is *Culicoides variipennis*, although other species of *Culicoides* probably transmit the viruses. These flies are commonly known as biting midges but also are called local names such as sand gnats, sand flies, no-see-ums, and punkies. Hemorrhagic disease characteristically occurs from mid-August through October, and this seasonality is related to the abundance of biting midges. The onset of freezing temperatures, which stops the midges, brings a sudden end to the outbreaks. How the viruses persist through the winter when midges are not active is not clear. Possibly, viruses could overwinter in a few surviving midges but it also is known that some ruminants can carry virus for several weeks.



**Adult female biting midge**

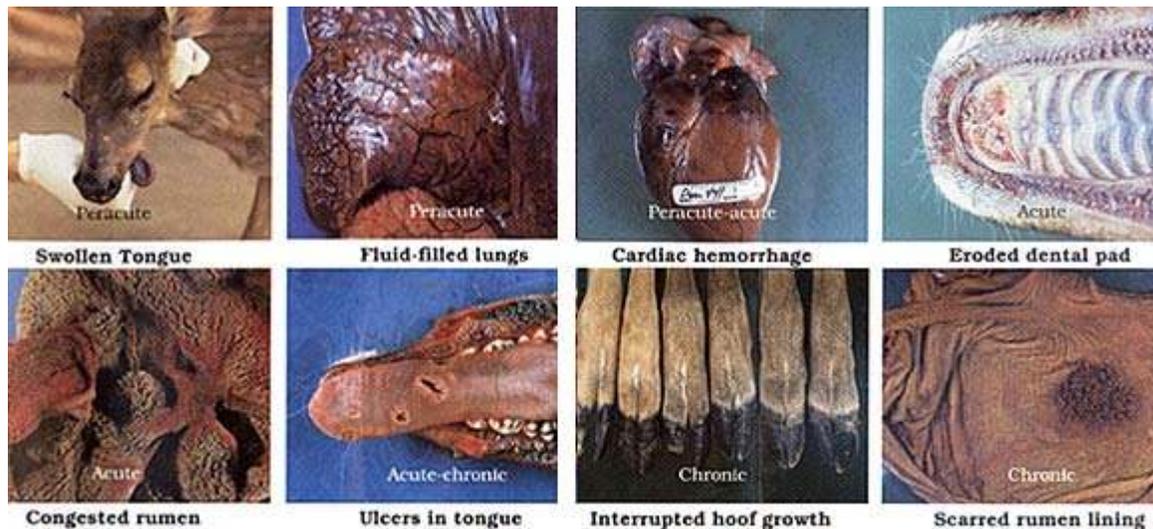
### **The Victims**

Hemorrhagic disease viruses are infectious to a wide range of wild ruminants. In addition to white-tailed deer, hemorrhagic disease has occurred in mule deer, black-tailed deer, bighorn sheep, and pronghorn antelope. Infections in these wild ruminants have ranged from inapparent to episodes of high mortality. In the Southeast, silent infections in white-tailed deer are common and are evidenced only by antibodies to the viruses in serum of normal, healthy deer. EHD and bluetongue viruses also infect domestic ruminants. Cattle and goats generally show no clinical illness or only mild disease when infected. In contrast, domestic sheep may develop severe illness when infected with bluetongue virus but apparently do not get sick when infected by EHD virus.

## What Are the Signs of Hemorrhagic Disease?

Outward signs in live white-tailed deer depend partly on virulence (potency) of the virus and duration of infection. Many infected deer appear normal or show only mild signs of illness. When illness occurs, the signs change as the disease progresses. Initially animals may be depressed; feverish; have a swollen head, neck, tongue, or eyelids; or have difficulty breathing. With highly virulent strains of virus, deer may die within 1 to 3 days. More often, deer survive longer and may become lame, lose their appetite, or reduce their activity. A smaller proportion of infected animals may be disabled for weeks or months by lameness and emaciation. Internal lesions, as with outward signs, can be quite variable in deer depending on virulence of the virus and duration of infection. The development of different lesions as the disease progresses has led to categorization of 3 "forms" of hemorrhagic disease—peracute, acute, and chronic. The peracute, or very rapid form, shows only severe fluid swelling (called edema) of the head, neck, tongue, eyelids, and lungs. In animals living somewhat longer, the acute or "classic hemorrhagic" form occurs. These animals may have edema in the same locations but also have hemorrhages or congestion in the heart, rumen, abomasum, or intestines. There may be erosions or ulceration on the dental pad, tongue, palate, rumen, omasum, and abomasum. The chronic form is typified by growth interruptions on the hooves and sometimes peeling of hoof walls. Other chronic lesions include ulceration, scarring, and loss of papillae in the rumen. It should be emphasized that not all of the above lesions may be found in an individual deer and that other diseases also produce similar edematous, hemorrhagic or ulcerative lesions.

### Lesions of Hemorrhagic Disease



### **When Should You Suspect Hemorrhagic Disease?**

Hemorrhagic disease should be suspected in instances of unexplained deer mortality during late summer or early fall, especially if any of the signs or lesions are noted. An easy lesion to see in the field is the erosion on the dental pad. Because deer have a high fever, they often are found near water. Sick or dead deer should be reported promptly to state wildlife agency personnel since other native diseases and even foreign diseases resemble hemorrhagic disease. If hunter-harvested deer have growth interruptions in their hooves or chronic lesion of the rumen lining or mouth, previous exposure to EHD or bluetongue can be suspected. However, virus is no longer present in deer with chronic lesions. Serum tests for antibodies from hunter-harvested deer, particularly deer less than 1 year old, may be used to estimate EDH or bluetongue virus activity in a herd during the preceding summer.

### **How is Hemorrhagic Disease Confirmed?**

A strong tentative diagnosis can be made on the basis of necropsy, but a confirmed diagnosis requires recovery of one of the causative viruses in tissue cultures or embryonating chicken eggs. Fresh specimens are essential for virus isolation because the viruses are killed as tissues decompose. Preferred specimens for virus isolation are refrigerated whole blood in anticoagulant containers and refrigerated or snap-frozen (-94F) spleen, lymph node, liver, kidney, lung, and bone marrow. Isolation success is very poor with improperly preserved tissues and from deer dead more than 24 hours.

### **How Many Deer Will Be Lost?**

Hemorrhagic disease occurs frequently, but its severity and distribution are highly variable. Past occurrences have ranged from a few scattered mild cases to dramatic outbreaks. Death losses during outbreaks usually are well below 25 percent of the population but in a few instances have been 50 percent or more. To date, there has not been a deer population wiped out by hemorrhagic disease.

### **Is An Outbreak Caused by Overpopulation?**

High density deer herds may have higher mortality rates; however, the relationship of deer density to the severity of hemorrhagic disease is not clear-cut. The number of deer that are immune, the virulence of the infecting virus, the number of livestock nearby, or the abundance of midge vectors may influence the outcome of infection within a deer population regardless of herd density. However, dense deer herds would be expected to support virus spread better than sparse herds.

### **Are Livestock Affected?**

In contrast to the significance of EHD and bluetongue viruses to white-tailed deer, the importance of these agents to domestic livestock is more difficult to assess. Most bluetongue virus infections in cattle are silent; however, a small percentage of animals can develop lameness, sore mouth, and reproductive problems. Cattle can be short-term bluetongue virus carriers. Less is known about EHD virus in cattle. EHD virus has been isolated from sick cattle, and surveys have shown that cattle often have antibodies to this virus, indicating frequent exposure. For domestic sheep the situation is more straightforward. Sheep are generally unaffected by EHD but bluetongue can be a serious disease similar to that in deer.

### **Will Livestock Become Infected From Deer?**

Past observations have revealed that simultaneous infections sometimes occur in deer, cattle, and sheep. Discovery of illness in deer indicates that infected biting midges are present in the vicinity, and thus, both deer and livestock are at risk of infection. Once virus activity begins, both livestock and deer potentially serve to fuel an outbreak; however, the spread of disease from deer to livestock, or vice versa, has not been proven. Furthermore, long-term carrier status for EHD or bluetongue viruses has not been reported in deer.

### **Can People Become Infected?**

Humans are not at risk by handling infected deer, eating venison from infected deer, or being bitten by infected *Culicoides* vectors. Deer that develop bacterial infections or abscesses secondary to hemorrhagic disease may not be suitable for consumption.

### **What Can Be Done to Prevent or Control Hemorrhagic Disease?**

At present, there is little that can be done to prevent or control hemorrhagic disease. Risks will be minimized in deer herds that do not exceed the carrying capacity of their habitat. This same concept holds true for most other diseases and parasites of whitetails. The best and only practical means of regulating deer populations is through properly managed sport hunting, including harvest of antlerless deer as necessary. Although die-offs of whitetails due to hemorrhagic disease often cause alarm, past experiences have shown that mortality will not totally decimate local deer populations and that the outbreak will be curtailed by the onset of cold weather. Livestock owners who suspect EHD or bluetongue virus infections should seek veterinary assistance to get diagnostic confirmation and supportive care for their animals.

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